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DESCRIPTION

The motion picture of which copyright registration is hereby sought represents the operation of electric starting and lighting apparatus in connection with an internal-combustion engine, and the picture is described in detail in the annexed scenario. Parts of the picture are substantially similar to print No. 1 presented herewith, these parts being designated, in the scenario, as showing "exterior view of engine and starter-generator". Other parts are substantially similar to print No. 2, these parts being designated as "diagram". Close-ups of various details are also used.

In the scenario the abbreviation "SUB:" indicates a sub-title which alternates with the pictorial parts of the motion-picture. "Label" indicates a legend appearing in connection with a pictorial representation. Instructions to "point out" indicate the appearance of a pointer moving across the picture.

MAIN TITLE OPERATION OF THE NORTH EAST MODEL G ELECTRIC STARTING AND LIGHTING SYSTEM ON THE DODGE BROTHERS MOTOR CAR.

SUB: The operation of automobile starting and lighting apparatus is not difficult to understand if the various principles involved can once be clearly perceived and their interrelationship recognized. To this end the performance of the equipment has here been analyzed into a sufficient number of stages to bring out the action of each separate principle in its simplest form. It should accordingly be borne in mind that the processes, here shown as taking place in slow succession, in reality, occur so nearly simultaneously that no actual steps are distinguishable.

SUB: General view of the engine and electrical system.

Scene 1 Exterior view of engine and starter-generator. Dissolve off the timing gear case showing the Starter-generator driving mechanism. Label and point out the following: (1) "The Starter-Generator" (2) "Starting Switch and Reverse Current Cut-out" (3) "Charging Indicator" (4) "Battery."

SUB: Electrical system shown diagrammatically.

Scene 2 Diagram. Label and point out the following: (8) "Engine Frame" (9) "Starter-Generator" (10) "Armature" (11) "Commutator" (12) "Brushes" (13) "Series Field Coils" (14) "Shunt Field Coils" (15) "Fuse" (16)"Battery" (19) "Charging Indicator" (20) "Wire Supplying the Lighting and Ignition Circuits" (21) "Reverse Current Cut-out", (22) "The Series Coil" (23) "Shunt Coil" (24) "Magnet Core" (25) "Contacts" (the label "Reverse Current Cut-out" should remain in while these last four labels appear and are explained by the pointer." (26) "Starting Switch."

STARTING

SUB: To crank the engine, the driver, after closing the Ignition Switch and adjusting the gas lever on the steering column, operates the Starting Switch. The current which is then allowed to flow from the Battery through the Starter-Generator causes it to run

as an electric motor.

Scene 3 — Exterior view. Driver's foot appears on the push rod and begins to press down. Upon completion of down stroke on the starting switch push rod, the Starter-Generator Sprocket begins to revolve in a clockwise direction, driving the engine sprockets by means of the chain. The top half of the chain should be taut to indicate the direction of pull.

Scene 4 — Diagram. Label (30) "Closing Starting Switch permits current to flow from battery to Starter-generator". The driver's foot dissolves in and immediately begins to press down. Call attention to movement of switch contactor by means of pointer. As soon as the switch closes, animate a movement in the battery and call attention to it with pointer. Point out and show arrows proceeding from battery through the switch to the positive binding post. Continue the arrows through the positive pair of Series Field Coils and Positive Main Brush to the Commutator. Continue the arrows through the commutator, through the negative main brush and negative pair of series field coils to the negative binding post. Arrows continue through ground strap, starter-generator field frame, through the engine frame, and to the battery. Label (33) "Current leaves Starter-generator by way of ground strap and field frame, and returns to Battery thru engine frame and battery ground connection".

SUB: The current flowing through the starting circuit sets up a magnetic field in the Starter-generator pole pieces, field ring, and armature.

Scene 5 — Same as end of Scene 4. Point to place where flux is to appear and at the same time dissolve in the lines of flux. Label (34) "The magnetic flux sets the armature in motion". Start the armature rotating in a clockwise direction. The speed of the armature should be built up quickly, but it should not rise above one-half revolution per second.

SUB: Besides flowing through the series coils to establish the main starting field, current also flows through the shunt coils in a direction to strengthen the main field.

Scene 6 — Same as end of Scene 5. Label (35) "Shunt field current leaves commutator through 3rd brush and after traversing shunt coils and fuse, joins main

current again in field frame". Arrows leave the commutator at the third brush and flow through the shunt field coils, fuse, and field ring, joining the main stream where it enters the engine frame.

Flash to close-up of Starter-Generator. Label (35-a) "The shunt field current adds to the density of the field flux". Flux at once dissolves to noticeably greater density while the current continues to flow. Label (36-b) "This increase in flux density reduces the speed slightly but gives added power". Show noticeable decrease in speed of armature but continued steady operation.

SUB: Current also flows through the shunt coil of the Reverse Current Cut-out at starting, but produces no effect in the Cut-out because the battery discharge voltage is too low to actuate it.

Scene 7 Same as end of Scene 6, but use general view instead of close-up. Arrows leave No. 1 contact-point and flow through the shunt coil in the Reverse Current Cutout, through No. 4 contact-point to engine frame, joining the main flow of current. Preceding this animation, point out the course of the current.

SUB: With the Ignition turned on, the engine, if properly supplied with gas, begins to run on its own power as soon as it has been turned over a few times by the Starter.

Scene 8 Same as end of Scene 1. Label (38) "As soon as the engine begins to run on its own power, it drives the Starter instead of being driven by it". Increase the speed of the crankshaft sprocket, and then point out the transference of tension from the top to the bottom half of the chain. Pointer calls attention to removal of driver's foot. Label (39) "The driver should now release the Starting Switch to open the starting circuit".

Scene 9 Diagram. Same as end of Scene 7. Remove the driver's foot and raise the switch, opening the contacts. Label (40) "Starter-generator becomes electrically inoperative until engine increases its speed to the generating point". Immediately

flash out all current. Cross-dissolve the flux to a very few lines.

GENERATING.

SUB: As the engine accelerates under its own power, the Starter-generator speed is raised to a point which enables it to "build up" as a Generator and produce current.

Scene 10 Same as end of Scene 9. Point with pointer to residual flux. Label (41) "A small amount of residual magnetism is always retained by the pole pieces". Indicate with pointer arrows circulating through commutator. Label (42) "This serves as the nucleus from which the generator field current is built up". Indicate with pointer the path of the current from the commutator through the third brush, the shunt field coils, the fuse, the field frame, the ground strap, the negative binding post, positive pair of series field coils, and the negative main brush back to the commutator. (The speed of this current is to be about 100% slower than that already demonstrated). Point to one air gap and then increase the flux density slightly. Increase the speed of the current arrows by 25% and also increase the flux density in like proportion. Label (45) "Current and flux continue to build each other up until a state of equilibrium is reached". (4 increases to be made in not over two-second intervals). Label (46) "Besides flowing in field circuit, current also traverses cut-out shunt coild circuit. Point out and show current (arrows moving at normal speed but much lighter in weight) flowing from the positive main brush through the positive series coils, positive binding post cut-out, shunt coil in cut-out, engine frame, to field frame where arrows join the field current arrows.

SUB: As the generator voltage attains its normal value (15 volts) the current flowing through the cut-out shunt coil circuit becomes strong enough to actuate the cut-out.

Scene 11 Show close-up of cut-out core and flash in label (11-1) "Current flowing in shunt coil establishes flux in magnet core". Point out and show flux dissolving into core(especially at the air gap) while current continues to flow in the shunt coil.

Label (11-2) "This flux attracts the cut-out armature and closes the contacts". Point quickly to portion of cut-out armature (directly above core) and then contacts. Then show armature being drawn down and contacts closed.

SUB: Closure of the Cut-out contacts permits current to flow from the Starter-Generator through the battery circuit.

Scene 12 Point out and show output current flowing through cut-out series coil, cut-out frame and contacts, charging indicator, battery, engine frame, field frame, ground strap, negative binding post, negative series coils, negative main brush. (Use normal weight arrows to supersede the light weight ones up to the cutout, and continue with normal weight through the series coils and remainder of charging circuit. Retain light arrows in shunt portion of cut-out circuit).

Label (49) "Current flowing through battery circuit is registered by charging indicator". Flash to close-up of Charging indicator with following label appearing at once before animation begins: (12-1) "Total output is 7 amperes". Show needle move to 7th division on indicator scale. Label (12-2) "But the ignition consumes 1 ampere" --- Point to ignition wire and flash in arrows flowing along it (make this action short) Label (12-3) "--- which reduces the current for the battery to 6 amperes". Point to and show needle moving back to division 6 on the scale.

SUB: In daylight driving when lamps are not in use the normal current delivered to the battery is 6 amperes. But at night when the lamps are turned on, they draw part of the output and the charging current is then cut down proportionately.

Scene 13 Continue close-up of indicator with current flowing as at end of scene 12. Point to position of needle at 6 amperes. Label (13-1) "Turning on lamps deflects additional current from charging circuit. Point to lamp and ignition wire and flash in heavy arrows in place of light ones, at same time substitute light arrows for heavy ones in charging circuit through indicator, and also point to light arrows. Label (13-2) "If lamps consume 4 amperes, charging current

to battery will be reduced to 2 amperes". Point to needle and show it move back at once to 2nd division on scale (while current continues flowing.)

REGULATION.

SUB: The output of a generator will always vary with changing speeds unless it is artificially regulated. In the North East Model G Starter-generator the output is controlled by two agencies: A "bucking" series field and a 3rd brush arrangement of the shunt field circuit.

Scene 14 Label (57) "Bucking series field". Label (58) "So long as machine functions as a generator, current flows thru series field coils and shunt field coils in opposite direction". Call attention with pointer to the difference in the direction of flow of current in the series field coils and in the shunt field coils. To emphasize the difference in direction, move the pointer in each instance along with the movement of the arrows. Label (59) "Series field is weak because of relatively few turns on series coils". Label (60) "It therefore only slightly opposes magnetizing effect of shunt coils at moderate outputs". Label (61) "As output current increases with rising speed, opposition of series field increases and cuts down the effectiveness of shunt field". Call attention with pointer to current flowing out and into commutator through the main brushes and then quicken the flow of the arrows perceptibly throughout all circuits. Then call attention to air gaps by means of pointer and show perceptible reduction in flux density. Label (62) "This tends to keep output constant in spite of speed change.

SUB: The bucking series field is not enough in itself, however, to compensate completely for speed variations. The chief regulating duty is, therefore, borne by the Third Brush System and the bucking series field is used only as an auxiliary means of control.

Scene 15 Begin with close-up view of starter-generator, with current flowing normally in all circuits. Label (15-1) "The 3rd brush is located between the two main brushes". Point to 3rd brush. Label (15-2) "All current is supplied to the shunt field coils through the 3rd brush". Point out (quickly) the

course of current from 3rd brush through shunt field coils back to armature. Label (15-3) "The field current is thus subjected to the influence of armature reaction" ... Label (15-4)"... which shifts and weakens the field flux as the speed rises". Show armature speeding up rapidly. Point to and show (in three quick stages) flux shifting to the leading tips of the pole pieces and at the same time decreasing to 1/2 normal density. Label (15-5) "The field current is thus modified in inverse proportion to the speed". Point to field circuit and show noticeable reduction in rate of flow of arrows (keeping speed and all other current unchanged.)

SUB: The 3rd brush system thus compensates for speed variations by producing changes of an opposite nature in the field circuit. In the North East machine this compensation is so effective that the output is not only prevented from rising with the speed, but is actually reduced whenever the speed exceeds a moderate value.

Scene 16 Show regular system with arrows in all circuits (suspended animation). Label (16-1) "The output reaches its maximum at about 1750 R P M of the armature". Show system in operation, armature running at slow speed, charging indicator reading 2 amperes. Point to armature and to indicator and then show speed and current rising (2-3 second intervals) to a moderate value with indicator pointing to division 6 on scale. Label (16-2) "Output remains constant from this point up to 2100 R P M". Point to and show (1) noticeable increase in armature speed; (2) slight shifting and reduction of field flux; (3) slight reduction of shunt field current; (4) finally indicator needle (which has remained steadily at 6th division). Label (16-3) "with further increases in speed, output is gradulally reduced". Point to and show (in quick succession) (1) further speed increase; (2) further shifting and reduction of flux; (3) further reduction of shunt field current; (4) and movement of indicator needle back from 6 to 4½ amperes. Then finally point out and show similar additional changes again (this time raising speed to the limit and reducing indicator reading to 3 amperes.)

OUTPUT ADJUSTMENT.

SUB: Adjustment of the output setting is accomplished by shifting the location of the Third Brush by means of an adjusting screw in the commutator-end housing.

Scene 17 — Call attention by means of pointer to location of Third Brush. Label (78) "To increase output, 3rd Brush should be shifted in direction in which armature rotates". Move the 3rd Brush in a clockwise direction approximately two bars. Label (79) "This includes additional portion of commutator between 3rd Brush and - main brush". Point out and show 25% increase in rate of flow of arrows in shunt coil circuit. Label (80) "The Field is thus given extra strength, and output is accordingly raised above its normal value". Point out and show 25% increase above normal in flux density at the four air gaps. Point out and show 25% increase in speed of flow of charging current, and also show movement of the indicator needle to the extreme left of the scale. Label (81) "To decrease output 3rd brush should be shifted against direction of rotation of armature". Move the 3rd brush in a counter-clockwise direction to apoint two bars to the right of its original position. Label (82) "This reduces field strength and cuts down output". Point out and show in approximate three-second intervals (1) The reduction of the rate of flow of the arrows in the shunt circuit to 25 % below normal. (2) The reduction of the flux density in the air gaps to 25% below normal. (3) The reduction of the rate of flow of the arrows in the charging circuit to 25% below normal. (4) The movement of the charging indicator needle back to a position approximately four degrees left of zero.

FUSE PROTECTION.

SUB: The electrical system is protected from injury by the fuse which is included in the shunt field circuit. This fuse is designed to "blow" if the voltage of the generator ever exceeds the limits of safety.

Scene 18 — Show system in operation the same as at the beginning of the preceding scene (17). Label (84) "Should the battery circuit become broken"-, show the wire breaking at that point, and also stop abruptly the flow of current throughout the charging circuit proper, but retain the small arrows in the shunt field circuit and the reverse current cut-out shunt circuit. Label (85) - "voltage of starter-generator will tend to rise rapidly to a point that might prove harmful to the equipment". Point out and show the arrows flowing through the shunt field and the cut-out shunt circuit in a rapid state of acceleration, and increase the thickness of the arrows up above that normally used in the charging circuit, and increase their rate of flow as high as practicable. Label (86) "As soon as

shunt field current exceedscapacity of fuse it causes fuse to blow". Point out and show the blowing of the fuse: efface the portion of the circuit that is shown in the fuse and make a small puff of smoke rise from the center of the top side of the fuse.

Label (87) "The instant fuse blows, entire machine is rendered electrically inoperative". Point out and show the abrupt stopping of all flow of current in the system. Also cut down magnetic flux to its minimum residual value. Label (88) "Starter-generator will not function again, even if charging circuit is repaired-". Point out and show the broken wire at the right of the positive battery terminal moving into place again so as to complete the circuit. Label (89) "Until new fuse has been installed to re-establish shunt field circuit". (armature to continue burning throughout three preceding labels.) Show new fuse being moved into place and show system resuming operation as at the beginning of the scene. This change must be flashed in.

STOPPING.

SUB: Whenever the speed of the Starter-generator is reduced so far that the generated voltage drops below the counter-voltage of the battery, the reverse current cut-out automatically opens the charging circuit to prevent current from discharging back from the battery through the Starter-Generator.

Scene 19 Same as end of Scene 18. Label (90) "Slowing down speed below 'cut-in' point reduces generated voltage to such an extent that battery can discharge back thru armature". Point out and show the fading out of current in all portions of the system. Also reduce the flux to the residual value and swing back the indicator needle to zero position. Immediately follwwing, with a smooth transition, flash in discharge current, represented by thin arrows, starting from the positive terminal of the battery flowing (1) through the charging indicator, (make the charging indicator needle swing about one division to the right of zero and call attention to it by means of the pointer) (2) through the out-out contacts (which are still closed), (3) through the cut-out series coil, (4) through the positive binding post, (5) series field coils, (6) positive main brush, (7) commutator, (8) negative main brush, (9) series coils, (10)negative binding post, (11) ground strap, (12) field frame;

(13) engine frame, (14) and the negative battery connection back into the battery. Also show with thin slow-moving arrows, normal current branching off from the commutator through the third brush, shunt field coils, fuse and field frame, uniting in the engine frame with the main discharge current. Also point out and show current flowing from the junction of the series and the shunt coils in the cut-out through the cut-out shunt coil and shunt coil ground connection, back to engine frame where it joins the main stream(use small arrows here also). Label (91) "Cut-out shunt coil continues to receive sufficient current to keep cut-out closed". Call attention by means of pointer to the direction of flow of current first in the cut-out shunt coil then in the cut-out series coil Label (92) "But discharge current passing through series coil neutralizes the magnetizing action of shunt coil". Call attention to disappearance of flux in the cut-out core. Label (94) "This releases cut-out armature, allowing it to spring back and open contacts". Point out and show opening of contacts. Flash out immediately all current in the series coils and contacts. Label (95) "Opening of the contacts immediately prevents all further discharge from baytery through starter-generato" Point out and show abrupt elimination of arrows in the charging circuit proper and also the swinging back of the charging indicator needle to the zero position. Label (19-1) "Weak field current continues to be generated until machine comes to a standstill". Retain the stream of arrows in the shunt field circuit and also in the cut-out shunt circuit. Show armature slowing down gradually to a standstill and accompany it by slowing down of stream of arrows flowing in the shunt field circuit and the cut-out shunt circuit. Finally fade out the current arrows just as they are about to reach a standstill.

Scene 20 — As at end of Scene 8. Show engine showing down to standstill.

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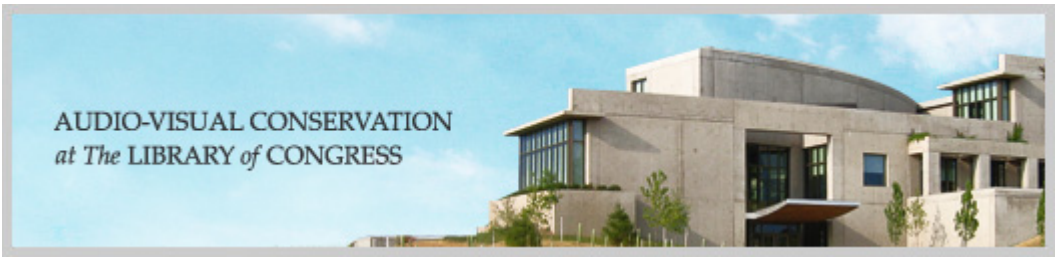

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